

**European Climate Change Programme**

**Working Group II  
Impacts and Adaptation**

**Human Health  
Sectoral Report**



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## **The EU's Adaptation Programme**

Adaptation is a new policy area for the European Climate Change Policy. The Impacts and Adaptation Workgroup has been set up as part of European Climate Change Programme (ECCP II). The main objective of the workgroup is to explore options to improve Europe's resilience to Climate Change Impacts, to encourage the integration of climate change adaptation into other policy areas at the European, national and regional level and to define the role of EU-wide policies complementing action by Member States.

The aim of this initial programme of work is to identify good practice in the development of information and adaptation policy and foster learning from different sectoral experiences and explore a possible EU role in adaptation policies.

The Commission has led a series of 10 sectoral meetings looking at adaptation issues for different sectors. One of these meetings looked at the impacts on human health. This report summarises some of the evidence of climate change attributable health impacts, and discusses the state of play in health adaptation gathered at the stakeholder meeting, held in early 2006.

### **Key impacts of climate change on human health**

Knowledge on the health impacts of climate change in Europe, derive from few European studies (ACACIA, cCASHh, Phewe, Ensemble, Eden), national climate change health impact assessments (see table 1), and studies carried out by several national research councils or agencies. Global assessments are carried out within the Intergovernmental Panel of Climate Change (the fourth assessment is expected for April, 2007) and by the World Health Organization.

These studies quantified effects of weather and climate variability on health characterized early impacts on human health, estimated some of the future burden of disease and provided some notions on potential future risks.

There are methodological difficulties in attributing health impacts to climate change, because (a) health outcomes are influenced by a variety of social, economic, environmental, health system and individual factors (b) data are not always available at the spatial and temporal scale needed (c) some health outcomes might not be considered within the wide variety of health outcomes, and (d) lack of exposure response functions and baseline health information.

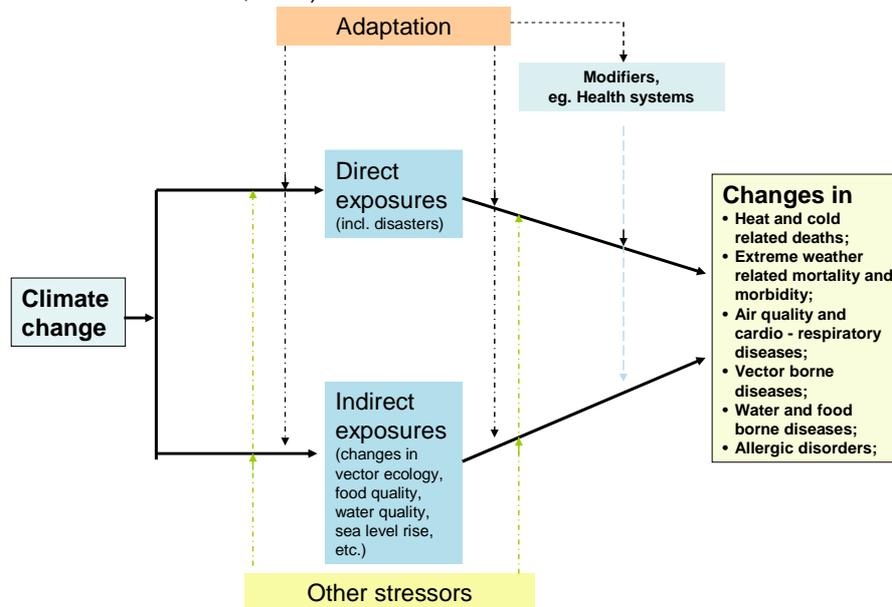
The observations of the last decades show that impacts vary significantly by location and by populations across Europe. Annual variability and multiple exposures might lead to enhanced effects, although little is known about this.

The actual future impacts on human health will very much be dependent on the character, magnitude and rate of climate variation to which "health" is exposed, the actual sensitivity and the ability of populations, governments, and health systems to cope with the consequences.

The use of scenarios to explore future effects of climate change on population health is at an early stage of development. The few quantitative models available, have either estimated the burden of disease, mapped potential shifts in distribution of some vectors/infectious diseases, like malaria or estimated populations-at-risk or person-months at risk.

European populations are both exposed to increasing frequency and intensity of extreme events and weather variability as well as to long term changes in mean temperatures and precipitation. These exposures either directly affect human health or affect health through changes in other systems or sectors (water, agriculture, ecosystems, biodiversity, food production).

Schematic diagram of pathways by which climate change affects health (adapted from McMichael et al, 2003)



There is a wide range of health impacts that have been observed or are projected:

1. heat-related mortality and morbidity,
2. health effects from other extreme events (floods, windstorms, fires, droughts),
3. changes in distribution of vectors, animals, and plants and potentially associated infectious diseases and allergic disorders,
4. food and water borne diseases, as well as stresses on drinking water supply,
5. health effects from the combination of changes in exposures from urban air quality and heat/cold.

In addition, while increasing demands on the health system, climate change also has the potential to impact on the ability of health infrastructure to meet those demands. For example, flooding/overheating of hospitals and old people's homes will directly impact health infrastructure, while there could also be a potentially greater demand on health services from environmental refugees, an increased need for doctors to recognise 'tropical' diseases and other climate change related demands on the health system.

Several of the key impacts of climate change on human health are summarised below:

#### *Communicable diseases*

Climate change can affect vector borne diseases in several ways: a) the survival and reproduction rates of vectors, b) the intensity and temporal pattern of vector activity and c) the rate and survival of the pathogen in the vector.

Species which spread diseases have been observed in higher latitudes and altitudes than previously, noting that climate is the limiting factor for the altitude/latitude distribution of many species. If the climate is changing, then some species may be able to expand their northern/mountainous distribution limits regardless of other factors. Such changes have been observed for several different species over the last decades such as plants, fish, insects and small mammals.

In addition, with ever-increasing travel and trade, and a subsequently increased volume of airplanes, roads, ships and migrating people, new diseases will be discovered in more countries. Changing climatic conditions may help some of these diseases to become established in new countries.

There are four important vector-borne diseases in Europe:

- leishmaniasis, transmitted by sand flies, which persists in the Mediterranean region,
- malaria, transmitted by mosquitoes, a problem for Eastern and Southern European borders,
- West Nile virus, transmitted by mosquitoes, scattered instances in Europe,
- tick-borne diseases, present throughout Europe.

Incidence depends on transmission potential (biological factors) and relative exposure (human factors). Warmer weather and milder winters are likely to increase the abundance and seasonality of some of the vectors (e.g. flies).

As yet, it appears that climate is an insufficient cause on its own for changing disease epidemiology, but signals in changes of vector distribution and density have to be taken seriously. The combined effects with other environmental exposures are also significant.

Little knowledge is available on emerging infectious diseases. A hypothesis is currently being tested relating to the potential reintroduction of autochthonous dengue fever to the Mediterranean and extension to central and northern Europe of Crimean Congo Fever. It is to be noted that the extension of Blue tongue (a veterinary disease) to Europe has been partly attributed to climatic changes.

#### *Food- and water-borne diseases*

While few studies have looked at the relationship between temperature and diarrhoeal diseases, seasonal patterns have been observed for many years. A study in Europe confirmed that temperature increases the number of salmonella cases. Campylobacter is the other prominent food-borne disease, although this disease shows a weak temperature effect. In the UK, a Campylobacter peak begins around May each year.

Heavy rainfall events might affect the runoff on microbiological contamination of coastal, recreational or surface waters and affect water quality and distribution systems. An example is given by a potential association between cryptosporidium cases and rainfall events. Further, a reduced ability of the water filtration system to cope and hence water quality can vary, leading to increased need for monitoring to ensure water standards are met.

Droughts will present risks in particular for coastal areas with high tourism activities in summer time. An increased risk of contaminated surface water reaching groundwater through the opening of short circuits can be expected as a result of lowered water table during times of drought.

Warmer seas may contribute to increased cases of human shellfish poisoning or pole ward expansions of the disease distributions. However, there has been little research in this area. Increased temperature and nutrient concentrations in surface water can increase the risk of cyanobacteria blooms. The links between mycotoxins and changing climate have not been explored.

#### *Extreme temperatures (extreme heat and cold)*

There is clear evidence for deaths from heat. The 2003 heat wave figures vary between 27.000 and 50.000 excess deaths over the summer months due to the heat wave. The health system played a substantial role, whereby the lack of knowledge, delayed treatment, overwhelming health services and lack of cooling facilities was an important determinant of health outcomes.

Analysis of long term meteorological trends carried out in recent years underlines that global warming is a reality, and that more heat waves are highly likely to occur in the future. This has been the case in 2006 but only for a short period compared with 2003. It will no longer be possible to express surprise at these climatic events and their consequences. We must reinforce policies for forecast, alert and prevention<sup>1</sup>.

Although anyone can suffer from heat-related illness at any time, some people are at greater risk than others (WHO, 2006). These include infants and children up to 4 years of age; people aged 65 years or more; people who are overweight may be prone to heat sickness; people who overexert during work or exercise may become dehydrated and susceptible to heat sickness. Other vulnerable groups include people confined to bed and unable to care for themselves; people who are physically ill and people who take medications that aggravate dehydration and heat exhaustion (e.g. diuretics).

Key risk factors for mortality are a combination of:

- duration of intensity of heat load,
- social circumstances,
- health system preparedness (including adequate access to environment and health information),
- types and positions of housing.

Mortality impacts are generally higher in cities. The increasing size and scale of cities is accentuating an urban heat island effect<sup>2</sup> whereby temperatures can be 2-15°C higher than the surrounding area. People are mostly exposed to heat (and air pollution) indoors, hence indoor air conditions are key, and factors such as a person's location within the city, quality of the building (e.g. type of building materials, air cooling, ventilation, closeness to roof) and internal sources of heat. Every city has a different threshold for mortality and also shows a different impact of a 1°C change on mortality. Such differences depend on the social and economic circumstances of

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<sup>1</sup> Budapest Environment and Health Ministerial Declaration and EC Environment and Health Action Plan.

<sup>2</sup> Urban heat island effect is due to the use of building materials, the lack of wind and presence of heat producing activities.

the city, with factors such as differences in the built environment, prevalence of air conditioners, available health system impacting on the mortality.

Impacts are greater in the south and in Mediterranean cities, though it is not clear whether this relates to regional differences or the length and severity of the heat waves. The significance of heat waves will increase in the future as the population gets older and becomes more vulnerable.

A small synergistic effect has been seen between excess heat deaths in cities and air pollution in summer and winter. The relationship between ozone pollution and excess mortality was estimated to be between 3% and 85% in nine French towns. The reason for this high heterogeneity between towns remains unclear, and demands further study.

Extreme cold has also been investigated and in most cases shows a negative effect on health. It is likely that winter mortality could be reduced with changes in the climate systems (e.g. reduced winter deaths due to warmer winters), however the overall balance is unclear.

Some studies have shown a shift in deaths from winter to summer. Different categories of people die as a result of weather changes and different groups are vulnerable in winter as opposed to summer, although the elderly seem vulnerable to both extreme heat and cold.

### *Allergies*

Several studies report evidence for climate change effects on timing and duration of allergenic pollen season and pollen amounts. An earlier onset, followed by a prolonged exposure to (sometimes) increasing concentrations of airborne allergenic pollens, implies a longer and possibly heavier period of symptom occurrence.

Few studies show the same evolution for allergenic mould spores or bacteria. Changes in the spatial distribution of natural vegetation, such as the introduction of new aeroallergens into an area, increases sensitization.

The introduction of new invasive plant species with high allergenic pollen, present important risks to human health, in particular ragweed (*Ambrosia artemisiifolia*).

Further rising CO<sub>2</sub> concentrations and temperatures could increase ragweed pollen production and prolong ragweed pollen season.

### *Flooding*

Floods cause an instantaneous reduction in quality of life, followed by a gradual return to a level close to the original quality of life. Most recovery takes place in the first six months after the floods, and then recovery becomes more gradual. Interventions before, during and after floods can significantly reduce short and long term health impacts.

While very few people consult their doctor about flooding impacts, many feel that their psychological or physical health is affected. When prior health is taken into account, the diverse impacts on different age groups are less noticeable, with a slightly increased impact on those nearing retirement age.

Flood events are the most frequently occurring natural disasters worldwide. The frequency of great floods increased during the twentieth century and may increase in the future as a result of climate change<sup>4</sup>. Adverse effects on human health include<sup>3</sup>:

- trauma deaths, mainly by drowning,
- injuries,
- enteric infections due to increased faeco-oral cycling from disruption of sewage disposal and safe drinking water infrastructure,
- mental health such as post-traumatic stress disorder,
- vector-borne disease, such as malaria, dengue and dengue hemorrhagic fever, yellow fever and West Nile fever,
- rodent-borne disease, such as leptospirosis,
- poisoning caused by toxic substances,
- snake bites as snakes tend to seek shelter in households to escape from flooding,
- other negative health outcomes, such as disruption of healthcare services and population displacement.

A limited number of short term epidemiological studies have been undertaken to assess the health impacts of flooding, but there is a deficiency in studies of long term health and economic impacts.

Indirect health impacts linked to flooding include increase in health risks such as Helminths, protozoa and viral and bacterial gastro-intestinal pathogens also, particularly in relation to waste water treatment during floods, increase in pesticide run-off and loss of crops.

#### *Health effects from other extreme events, e.g. fires*

In Southern regions, changes in the mean and variability of temperature and precipitation are projected to increase the frequency and severity of fire events. Forest- and bush-fires cause burns, inhalation and other injuries. Large fires are also accompanied by an increased number of patients seeking emergency services, including health care providers, affected by smoke and ash. Toxic, gaseous and particulate air pollutants are released into the atmosphere, which significantly contribute to acute and chronic illnesses of the respiratory system, particularly in children, including pneumonia, upper respiratory diseases, asthma and chronic obstructive pulmonary diseases.

Sea level rise will present an additional risk to human health as 9% of European populations live in coastal areas of less than 5m elevation.

#### *Air pollution*

Weather determines the development, transport, dispersion and deposition of air pollutants. Certain weather patterns enhance the development of the urban heat island, the intensity of which may be important for secondary reactions within the urban atmosphere, leading to elevated levels of some pollutants. There is an enhancing interaction between extreme temperatures and the degree of air pollution. Concentrations of air pollutants, such as fine particulate matter (PM), may change in

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<sup>3</sup> See the web site **Unexpected events leading to an excess of mortality**  
[http://ec.europa.eu/health/ph\\_information/dissemination/unexpected/unexpected\\_en.htm](http://ec.europa.eu/health/ph_information/dissemination/unexpected/unexpected_en.htm)  
directly linked to the European Union Health Portal  
[http://ec.europa.eu/health-eu/my\\_environment/index\\_en.htm](http://ec.europa.eu/health-eu/my_environment/index_en.htm)

response to climate change because a portion of their formation depends, in part, on temperature and humidity.

This often leads to air quality limit value or standard being exceeded (episodes of summer and winter smog). Two components in particular are important with respect to the health effects of air pollution: ground-level ozone and particulate matter. Ozone is only important as an air pollutant during the summer. Particulate matter, on the other hand, is a problem throughout the year, although levels are higher in the winter. Research shows that both short- and long-term exposure to these substances are associated with a large number of health effects (including premature death and increased illness). There are also indications that health effects arising from simultaneous exposure to stressful weather conditions and air pollution are greater than the sum of the separate effects.

It is expected that climate change will influence the frequency and concentration of both summer and winter smog. In addition to the effect in rural regions, increased air pollution as a result of climate change poses a particular problem in highly polluted urban areas.

A small synergistic effect has been seen between excess heat deaths in cities and air pollution in summer and winter.

As a result of a photochemical process on sunny and warm days, ozone is formed from nitrous oxides and volatile organic substances. Although still uncertain there seems to be no threshold value for the occurrence of ozone-related health effects. The higher the ozone levels, the greater the increase in, and severity of, the effects. Risk groups are people who exercise outdoors, people with cardiovascular diseases and respiratory problems, and people who are extra sensitive to ozone exposure. The relationship between ozone pollution and excess mortality was estimated to be between 3% and 85% in nine French towns. The reason for this heterogeneity between towns remains unclear, and demands further study.

Climate change will result in an increase in the number of summer days, with the result that the probability of smog formation will increase. Another phenomenon that is in part associated with climate change is the increase in the background concentration of ozone in the entire Northern Hemisphere. In the absence of a threshold value for effects, an increase in this background concentration will have a direct negative influence on the health. This impact is difficult to estimate quantitatively.

### **Existing/Relevant policies at the EU level**

Currently there are no direct health adaptation policies to climate change. However a number of EU policies do directly address climate related extremes and health concerns, although climate change could be better reflected within these policies:

- EU's Environmental Health Action Plan, which is currently in progress. Action 8 relates to emerging issues and highlights climate change and human health aspects of extreme weather events and communicable diseases,
- the first calls for the Seventh Framework Programme (FP7) are now being prepared; two of these topics relate directly to this issue,
- a protocol on water and health has been ratified by several member states,
- guidance on flood prevention has been developed.

There are some existing policy areas that do not explicitly or originally refer to climate change but still are addressing many of the impacts of climate change. This includes, for example, the policy environments of:

- civil protection (DG ENV) which deals with preparedness and response, mainly to natural and man-made disasters,
- DG SANCO operates as:
  - health information and determinants supporting projects such as EURO HEAT and Canicule 2003, disseminating large EU and national information on heat wave prevention and other catastrophic events<sup>4</sup>,
  - the health threats area managing early warning systems,
  - European Centre for Disease Control for the management of communicable diseases in extreme weather events.

In order to address the research needs the first calls for the Seventh Framework Programme (FP7) do address topics that relate to the issues (e.g. desertification and droughts).

In addition to these policies at the European level, a comprehensive Environment and Health Information System is being developed in cooperation with the WHO, as a tool to support policy-making, allowing priorities to be set on the basis of evidence, enhancing access to information and facilitating communication with the public (and setting the stage for additional developments).

### Examples of existing initiatives at Member State level

Several pieces of work have been carried out in Member States with relevance to adaptation and human health; these are mainly national health impacts assessments and are described in more detail in Table 1.

**Table 1:** *National Health Impact Assessments of Climate Change* (adapted from IPCC 4AR chapter 8 working group 2, forthcoming).

Country	Key findings	Adaptation recommendations
Finland (Carter <i>et al.</i> 2005)	Small increase of heat related mortality; changes in phenological phases and increased risk for allergic disorders.	Awareness building and training of medical doctors.
Germany (Zebisch <i>et al.</i> 2005)	Observed excess deaths from heat waves; changing ranges in tick-borne Encephalitis; increased hospital admissions.	Increase information to the population; early warning; emergency planning and cooling of buildings; insurance and reserve funds.

<sup>4</sup> [http://ec.europa.eu/health/ph\\_information/dissemination/unexpected/unexpected\\_en.htm](http://ec.europa.eu/health/ph_information/dissemination/unexpected/unexpected_en.htm)

Portugal (Casimiro and Calheiros 2002; Calheiros and Casimiro 2006)	Increases in heat related mortality by 2020s to range of 5.8-15.1 deaths per 100,000, from baseline of 5.4-6 deaths per 100,000; general increase in annual percent of days within favorable transmission of malaria and dengue; potential for West Nile fever, Lyme Disease and Mediterranean spotted fever; a reduction in leishmaniasis risk in some areas.	Address thermal comfort; education and information as well as early warning for heat periods; early detection and surveillance of infectious diseases
Spain (Moreno 2005)	Increase in heat-related mortality; air pollutants; potential change of ranges of vector and rodent borne diseases.	Awareness raising; early warning systems for heat waves; surveillance and monitoring; review of health policies
Switzerland (Thommen Dombois and Braun-Fahrlaender 2004)	Increase of heat-related mortality; changes in zoonoses; increase in cases of tick borne encephalitis.	Heat information, early warning; GHG emission reduction strategies to reduce secondary air pollutants; set up a working group on climate and health.
The Netherlands (Bresser 2006)	Increase in heat-related mortality; increase of air pollutants; risk of more Lyme disease cases, food poisoning and allergic disorders.	Not considered.
United Kingdom (Department of Health and Expert Group on Climate Change and Health in the UK 2001)	Medium-high climate change scenario results in an estimated annual 2800 heat deaths in the UK in the 2050s (250% increase). Greater reductions in cold-related mortality. Health impacts of increased risks from flood events.	Awareness-raising.

Very few adaptation initiatives in relation to human health have been documented in Europe. This partly reflects the early stage of development of this topic, and partly relates to the fact that not all activities relevant to the human health impacts of climate change explicitly refer to climate change. For example, in the areas of flood management and food-borne and vector-borne disease, there is notable activity looking at the human health impacts of climate factors or events, although it does not explicitly consider the additional impacts due to climate change in all instances.

Examples of existing initiatives that are specifically focussed on climate change are:

- the Health and Sustainable Cities Campaign initiated in the UK, as well as the Health Protection Agency, which has considered the role of the Environmental Health Action Plan. Actions are also triggered by alerts from the Met Office as part of the Heat Health Watch<sup>5</sup>,

<sup>5</sup> [http://www.metoffice.gov.uk/weather/europe/uk/heat\\_health.html](http://www.metoffice.gov.uk/weather/europe/uk/heat_health.html)

- the `Ruhrgebiet, a large network of cities in the oldest industrial area in the Western part of Germany, is looking at rebuilding housing in a way that can ensure it is climate-proof and safer for the older population who will be living there. Although not addressing climate change directly, lessons can be learned from the planners attempt to create a cooler urban climate,
- some examples of adaptation measures for flooding have been identified by practitioners including concrete thresholds on front doors and bathroom doors to stop flood waters rushing in,
- the French approach, a rather comprehensive adaptation strategy (mentioned in the Urban Planning and Infrastructure Working Group) for climate change is a survey of foreseeable impacts, adaptation options and current answers. It is currently in an advanced formative status. It contains a very comprehensive list of conclusions including research findings on human health observations,
- several European countries have installed heat health warning systems (HHWS) to prevent heat related morbidity and mortality e.g. France, UK, Germany.

### **Gaps identified**

We do have some information on, but not a comprehensive overview of, action at Member State level. Reporting to and monitoring by the Commission would allow identification of good or best practice.

There is a need for greater research into the direct health effects from climate change. There are big gaps in knowledge in relation to quantitative analysis that would help inform decision-makers by providing an argument for further work in this area. For example, the information is probably insufficient at this point in time to make detailed policy recommendations in relation to climate change and health.

The greatest focus so far has been on heat, with large gaps in knowledge or decisions by member states to de-prioritise considering other areas. However, even with respect to heat, the exposure-biological mechanisms as to why people are dying are not completely understood and there is a need for improved multi-disciplinary science to be applied to this issue.

Specific gaps identified were:

- there is a lack of mechanisms to predict events and then rapidly detect and measure the health impacts, adequately taking into account potentially interacting factors (such as socio-economic determinants),
- there is inconsistency in the level of preparedness between countries, some countries show more gaps than others, both in planning and ability to respond,
- the effects of climate change on health systems and their ability to adequately cope with the health impacts of climate change has not been explored at all,
- only one WHO report identifies the gaps for data reporting for this area<sup>6</sup>,
- there is a research gap about what types of houses are safer for people regarding heat risks, and there is no mapping of high risk areas within cities to target planning appropriately. In addition it should be studied how outdoor temperature affects the indoor thermal situation,
- there is some work available on adaptive actions for certain areas of human health, e.g. TBE vaccination, public health campaigns and food diseases, but work needs to be continued and enlarged on heat waves and information on risk assessments,

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<sup>6</sup> [www.euro.who.int](http://www.euro.who.int)

- flood management within a changing climate is challenging and there is a need for the right information from climate specialists; which is currently lacking. Particular information required includes run-off coefficients, which are path dependent and relate to previous weather,
- there is need for research on the usefulness of early information systems based on medium and long-term weather forecasts (monthly or seasonal forecasts),
- there is a need to strengthen, develop and broaden the environment and health information system, making it capable of providing a timely and comprehensive picture of the environment and health situation at EU and Member State level.

### **Opportunities for the EU level**

A number of opportunities were identified at the EU level. Due to the nature of health, many actions will need to be facilitated at EU level but then implemented and supported at a member state level. Given the overall early stage of development of this area, as well as taking an overall facilitation role, there is also a need for the EU to boost the progress and development of this topic in a more general way.

Due to the cross-disciplinary nature of addressing health impacts, many areas of activity of the EU have a role in influencing the many social and environmental determinants that make the health impacts of the different climate change impacts more acute.

Some of the overall roles for the EU, in collaboration with other partners, identified were:

#### *Information and Knowledge*

- there are many players in this agenda, therefore it is important that the Green Paper highlights all the players involved, both inside and outside the health sector, and specifies their roles. EU framework for this issue must be mainstreamed and integrated into the current policy approach as the topic is broad and can not be a stand alone issue,
- there is a role for the EU to coordinate further work to identify data and research gaps, and link some of the existing data and research projects to the policy agenda (e.g. ENHIS2, EUROHEAT, Canicule 2003, PESETA, EDEN, INTERESE, ADAM),
- identification, measurement and ranking of key health risks through a European wide expert panel (including WHO Euro, ECDC, EEA, WMO, IFRC, etc):
  - including multiple global environmental exposure risk mapping for 2030 and 2050,
  - including estimating the future burden of disease, by building on the WHO guidance under different timelines,
  - including the identification of high risk areas and populations (e.g. coastal zones),
- the EU should harmonise interventions across regions and countries to facilitate the sharing of data and lessons learnt, e.g. awareness raising with examples of best and good practice,
- there is a role for the EU to improve access to information for stakeholders. For example, improving the current information on the health impacts of weather and climate extremes at the European level provided by DG SANCO<sup>7</sup>,

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<sup>7</sup> A potential communication portal could be the [DG SANCO health portal](http://ec.europa.eu/health-eu/my_environment/index_en.htm) [http://ec.europa.eu/health-eu/my\\_environment/index\\_en.htm](http://ec.europa.eu/health-eu/my_environment/index_en.htm).

- more effective and efficient interventions should be developed and evaluated, such as early warning systems following the DG SANCO existing framework for communicable diseases, to reduce negative impacts,
- the potential role for a consistent approach on surveillance across the EU should be explored, dealing with both regular monitoring and emergency alert systems and data that will enable the analysis of patterns. There should be health surveillance monitoring in extreme cases of weather, e.g. to see the possible effects of hot dry summers, and alert systems need to be linked to the health system as it is done at national level in several Member States,
- health surveillance under multi-stresses is a very important area and there may be a need to set up a global health alert system (especially regarding vector borne diseases),
- an important EU role could be quantifying climate change risks to human health and the communication of these risks, both to key policy-makers and the public. For example, carrying out impact assessments to prove that climate change is a serious problem for human health, and improvement of the risk assessment methodology for climate and health,
- with regard to impact assessments, it would be useful to have some mathematical models to enable these assessments to be made (e.g. ticks/vectors, pollen, etc.),
- there is an EU role to support via the Public Health Programme the wide range of areas where research and development are required, for example:
  - health effects of temperature rise,
  - health effects of air pollution,
  - infectious diseases transmitted by insects and ticks, e.g. tick-borne encephalitis, malaria (vector-borne and rodent-borne diseases),
  - infectious diseases transmitted in the water supply or through food (water-borne and food-borne diseases),
  - allergy rise,
  - health impacts of flooding and storms,
  - forecasting events which can impact on human health,
- impact and adaptation assessments could benefit from the development of studies and generation of databases (consistent with existing information systems) which cover:
  - surveillance and monitoring of pathogens,
  - epidemiological studies on exposure and relative risks,
  - risk and (cost-)benefit modeling,
  - risk and adaptation communication,
  - adjustment of environmental and health guidelines, standards (limit values), and protocols, taking climate change effects into account,
  - embedding of climate change issues into National Environment and Health Action Plans (NEHAPs),
- standardise and harmonise data collection on mortality and morbidity (especially on heat) between countries as far as possible taking into account the differences in health systems in Europe,
- vector-borne diseases:
  - consistency in approach across Europe is needed and Europe could take action by facilitating TBE vaccination (noting however that different cultures view vaccination differently and this may make action at a European level a challenge),
  - noting that the species which spread vector-borne diseases often breed and live in wetlands or marsh areas, policies should be investigated and developed which result in the management of water levels in such areas so that unfavourable habitats are created for these animals,

- water-borne diseases:
  - develop indicators and monitoring for water-borne diseases,
  - help support awareness raising,
  - work on supporting expert groups, addressing research gaps and coming up with a long-term strategy for water resources,
- food-borne diseases:
  - improve consistency of approach across the EU,
  - identify areas for focused surveillance,
- air pollution health damage:
  - develop strategies to study long-term health damage by ground-level ozone.

#### *Policy planning process*

- developing a European strategy for the short and long term, to ensure adaptation to climate change occurs,
- reporting to, co-ordination of, and monitoring by the Commission of Member State action to adapt to climate change in their health policy would allow the identification of good or best practice,
- the EU could integrate or link existing policies and warning systems (e.g. Danube), which are in place, with or to each other and to the health ministries or secretariats, such as the ECDC, the Protocol on Health and Water (signed by various states), the Flooding Directive, the Environmental Health Action Plan (including the potential to increase the role of such action plans in cities), and the WHO Euro interagency network,
- priority setting is a key issue, given the amount of work to be done. However, it is important to keep in mind that priorities will differ country by country, rather than by topic, as the key issues depend on the situation at a given time and in a given country. At the same time, there are some joint cornerstones in the overall policy planning process which could be shared by all Member States, within a risk management framework,
- the European Centre for Disease Control should look at the question of climate change consequences on communicable diseases, to ensure that it is part of their mandate and responsibility,
- the EU could develop guidelines for gathering data and estimating the burden of disease due to weather and climate extremes in order that all EU policies are based on a more comprehensive health impact assessment,
- ensure that existing policy mechanisms address climate change risks, such as the current protocol on water and health, building standards and regulations, food safety standards, strategic environmental assessment, etc.,
- developing and standardising some key indicators to monitor changes in health impacts, to allow for inter-country and intra-country comparison, to monitor progress on adaptation effectiveness. For example, there should be agreement to a defined set of diseases to be notified and standardisation of some key indicators for these diseases, related to extreme weather events,
- these indicators should be developed to allow for inter-country and intra-country comparison and monitoring of progress, linked to an integrated environment and health monitoring system,
- the EU could facilitate a process in member states to help reduce heat risks associated with new build, possibly as part of a comprehensive set of guidelines for urban planning conducive to better health,
- consideration to specific standards and directives that need to be updated to ensure that existing and new houses can meet heat risk (and other challenges from climate change), such as the use of Strategic Environmental Assessments, new building design standards,

- support the continued integration of climate change health adaptation into overall health and non-health policy areas,
- develop guidelines for the evaluation of surveillance systems for food borne diseases,
- unify definitions for diseases across the relevant policy areas and organisations,
- strengthen Europe's policy to further decrease summer smog and ground-level ozone pollution.

#### *Risk and Disaster management*

- expanding risk assessment models to include temperature, so that risks for food-borne diseases can be better analysed,
- development of a system for rapid and efficient information distribution to the population (i.e. warning of a forthcoming heat wave, flooding, summer smog episode, pollen and ticks periods),
- civil protection: while member states have the overall responsibility and leadership remains local, the EU role is to coordinate resources and share capabilities, including:
  - planning, capabilities, exercises and training for catastrophic events which overwhelm Member States,
  - research and development, e.g. modelling, forecasting and scenario building, high capacity pumps,
  - EU coordination of help (with local leadership),
  - gap-filling exercise,
  - best practice examples of how to organise a response hierarchy,
  - deliver clear, simple advice and important messages centrally (e.g. preventing motorists from driving into flood water),
  - provide key capabilities that may be lacking at a member state level in emergency communication, damage assessment, logistics, EVAC and mass care.

#### **Actions relevant at national/regional/local level**

Some recommendations which could be more relevant, or also relate to the national or local level are listed below:

- explore the need for additional vaccinations or strengthening of vaccination practices, to address communicable diseases,
- explore the probabilities of future risks at the national level, e.g. future risks from flooding,
- study meteorological systems that cause flooding (e.g. look at the overall chance of flooding events in three major rivers in the UK), to help clarify the effects that climate changes will have on the probabilities of flooding events,
- explore the necessity of developing cooling facilities in public buildings, such as hospitals and care homes for the elderly, as an adaptation measure to extreme weather,
- building materials and new building standards should be considered, as well as potential effects on ventilation and indoor air quality,
- explore building standards for climate change,
- consider strengthening monitoring of pathogens in animals as well as humans (currently data to determine seasonality or temperature sensitivity to pathogens in animals is lacking),
- creation of registers of people at risk, especially during heat waves or extreme weather events,
- explore the development of financial support structures to avoid some of the downstream financial disasters associated with natural disasters,

- ensuring that water treatment plants are well-managed and have considered climate change into their management plans,
- maintain the range of existing tools (e.g. food-borne disease surveillance, microbiological risk assessment, bathing and drinking water quality standards) to address water quality,
- mapping of vector-borne diseases at the regional level, improve surveillance systems (e.g. screen blood donations for past exposure) and creating predictive risk maps could help direct activities into those areas of potential risk even where there has not yet been contact with the disease,
- food hygiene and production should be under one authority in order to address food-borne diseases,
- maintain and strengthen public advice on risks and prevention of climate associated health effects, including food hygiene practices in summer time,
- ensure that all new health infrastructure is located, designed and constructed for the climate change it will experience over its lifetime,
- prioritise retrofitting existing health infrastructure so that it can withstand the climate change it will experience over its remaining lifetime.

#### Further references and weblinks

- WHO Euro, through the Ministerial Conference for Environment and Health, has developed the following (which are available at <http://www.euro.who.int/globalchange>):
  - *Methods for assessing health vulnerability to climate change* (2003) (Kovats et al), [http://www.euro.who.int/globalchange/Publications/20031125\\_1](http://www.euro.who.int/globalchange/Publications/20031125_1)
  - *Methods for assessing the burden of disease* (2003) (Campbell Lendrum et al),
  - *Indicators* (2001) (WHO meeting report),
  - *What adaptation is needed* (ccashh) (2005) (Menne et al),
  - *Guidance for heat prevention* (2003 and 2006) (Koppe et al; WHO et al),
  - Heatwaves: risks and responses, [http://www.euro.who.int/eprise/main/who/progs/cash/HeatCold/20040331\\_1](http://www.euro.who.int/eprise/main/who/progs/cash/HeatCold/20040331_1)
  - *WHO guidance on the prevention of heatwaves*, available at [http://www.euro.who.int/globalchange/Topics/20040614\\_1](http://www.euro.who.int/globalchange/Topics/20040614_1)
  - The WHO Euro information on climate change, health and floods, [http://www.euro.who.int/globalchange/Topics/20030310\\_2](http://www.euro.who.int/globalchange/Topics/20030310_2)
  - Public health responses to extreme weather events, [http://www.euro.who.int/eprise/main/WHO/Progs/GCH/Topics/20050809\\_1](http://www.euro.who.int/eprise/main/WHO/Progs/GCH/Topics/20050809_1)
- Intergovernmental Panel of Climate Change [www.ipcc.ch](http://www.ipcc.ch)
- EU funded project on Integrated Flood Risk Analysis and Management Methodologies <http://www.floodsite.net/>
- European Public Health Alliance, Environment Network [www.env-health.org](http://www.env-health.org)
- Menne, B., Ebi, K., *Climate Change and Adaptation Strategies for Human Health*, Steinkopff Verlag Darmstadt, 2006

- Further information on the ENHIS2 project can be found at [http://ec.europa.eu/health/ph\\_projects/2004/action1/action1\\_2004\\_24\\_en.htm](http://ec.europa.eu/health/ph_projects/2004/action1/action1_2004_24_en.htm) and <http://www.enhis.net/>
- Systematic literature review on the health effects of floods <http://epirev.oxfordjournals.org/cgi/content/full/27/1/36>
- The EDEN ([www.eden-fp6project.net](http://www.eden-fp6project.net)) project which is looking at communicable diseases and extreme weather events
- The cCASHh project (climate Change Adaptation Strategies for Human health) <http://www.euro.who.int/ccashh> , assessed the health impacts of heatwaves and floods, as well as the impacts of climate change on six vector borne, three food and water borne diseases. Proposals for adaptation are given and prioritized. Results are available on the WHO website and in the book: Menne, B., Ebi, K., *Climate Change and Adaptation Strategies for Human Health*, Steinkopff Verlag Darmstadt, 2006, and [http://www.euro.who.int/eprise/main/WHO/Progs/GCH/Publications/20051202\\_](http://www.euro.who.int/eprise/main/WHO/Progs/GCH/Publications/20051202_)
- The INTERESE project is currently in progress and will produce some output in three years <http://intarese.imperial-consultants.co.uk/>. This project is designed to support implementation of the European Environment and Health Action Plan, by providing the methods and tools that are essential to enable integrated assessment of environment and health risks. Results from these will be used both to refine the assessment methods and to provide specific information on health implications of current and potential future, policies. Based on the results, a toolbox for integrated environment and health risk assessment will be developed, which will be further tested and demonstrated through a series of higher level policy analyses.
- The PESETA project reports are due for September 2006, addressing the physical impacts of climate change and health, and the report on costs is expected in January 2007. Note that some information can be made earlier in July 2006 to feed into the Green Paper on adaptation
- PHEWE, looking at overall climate issues, and its follow up project EUROHEAT, which has a detailed focus on prevention of health effects from heat waves. <http://www.epiroma.it/phewe/>
- ENSEMBLES, forecasting and measuring future changes. <http://www.ensembles-eu.org/>
- The European Research on Climate Change catalogue describes the work going on in relation to this topic area.
- The DG SANCO 'Unexpected events leading to an excess of mortality' web site which provides extensive information about mortality associated to extreme weather events and other situations [http://ec.europa.eu/health/ph\\_information/dissemination/unexpected/unexpected\\_en.htm](http://ec.europa.eu/health/ph_information/dissemination/unexpected/unexpected_en.htm)
- The EU project [EURO HEAT - Improving Public Health responses to extreme weather/heat-waves](http://ec.europa.eu/health/ph_projects/2004/action3/action3_2004_06_en.htm), [http://ec.europa.eu/health/ph\\_projects/2004/action3/action3\\_2004\\_06\\_en.htm](http://ec.europa.eu/health/ph_projects/2004/action3/action3_2004_06_en.htm),

[http://www.euro.who.int/eprise/main/who/progs/gch/Topics/20050524\\_2](http://www.euro.who.int/eprise/main/who/progs/gch/Topics/20050524_2), which coordinate actions to reduce disease burden, collaborate among public health authorities, meteorological services and agencies (national and international), emergency response agencies and civil societies in developing local, regional, national and European interventions; to facilitate the sharing of information, data and lessons learned; and to elaborate tools for early warning systems as well as address rapid information exchange.

- The EU project *Etude de l'impact de la canicule d'août 2003 sur la population européenne* [http://ec.europa.eu/health/ph\\_projects/2005/action1/action1\\_2005\\_full\\_en.htm#17](http://ec.europa.eu/health/ph_projects/2005/action1/action1_2005_full_en.htm#17) which investigate on the preponderant impact on mortality at older ages in terms of changes in biometeorological indicators such as the minimal, maximal and average temperature and in terms of duration, dew point temperature (temperature and humidity), concentrations of ground-level ozone, and the level of air pollution etc. This project will discuss a sensitivity of thresholds of different variables that have triggered off the excess mortality during the heat waves of 2003.
- MICRODIS: Integrated Health Social and Economic Impacts of Extreme Events: Evidence, Methods and Tools (Project under negotiation by DG Research-no website yet). Recent events such as the Pakistan earthquake, Hurricane Katrina, the Indian Ocean tsunami and the European heat waves of 2003 reveal the vulnerability of societies to extreme events. The goal of this project is to strengthen prevention, mitigation and preparedness strategies in order to reduce the health, social and economic impacts of extreme events on communities. This integrated project involves partners from Asia and Europe, including research and ground roots institutions.
- The Centers of disease heat prevention plan. [http://www.bt.cdc.gov/disasters/extremeheat/heat\\_guide.asp](http://www.bt.cdc.gov/disasters/extremeheat/heat_guide.asp)
- The French heat prevention plan. [http://www.bt.cdc.gov/disasters/extremeheat/heat\\_guide.asp](http://www.bt.cdc.gov/disasters/extremeheat/heat_guide.asp)
- The Italian heat prevention plan. <http://www.protezionecivile.it/>
- The Spanish heat prevention plan <http://www.msc.es/ciudadanos/saludAmbLaboral/planAltasTemp/home.htm>
- The US EPA has just released a guidebook for the public and for public health officials on how to deal with heat events this summer. Heat is the number one weather-related killer in the USA. <http://www.epa.gov/hiri/about/heatguidebook.html>